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The relationship of limited mobility of the cervical spine with postural and mental reactions of students

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ABSTRACT

Introduction: Previous studies have found that, in addition to the general factors for the occurrence of pain and reduced mobility of the cervical spine, the use of electronic devices promotes these, the excessive use of which can also lead to the occurrence of depressive symptoms in students. The aim of this study was to determine the mobility limitation of the cervical spine in students with reported neck pain, to determine the degree of disability and depression due to neck pain, to determine the correlation of mobility limitation of the cervical spine with the degree of disability and depression of students, and to determine the correlation of the degree of disability with the degree of depression.

Methods: The research was conducted as a cross-sectional study from May to July 2021 at the University of Zenica in four faculties. The study used the General Questionnaire and two standardized questionnaires to assess disability due to neck pain (Index of Disability due to Neck Pain) and the degree of depression (patient health questionnaire).

Results: A total of 147 students with reported neck pain participated in the study. A limitation of mobility was found in 30.6% of the students in flexion, 25.2% in rotation, 23.8% in lateral flexion, and 20.4% on extension. Mild disability due to neck pain was found in 58.5% of students, moderate in 23.8%, and severe in 2.7%. 45.6% of the students had mild depression, 18.4% had moderate depression, and 5.4% had severe depression.

Conclusion: Restricted flexion and rotation are more common than restricted lateral flexion and extension of the cervical spine. About half of the students who reported neck pain had a mild degree of disability and mild depression. A strong positive correlation was found between the degree of disability and depression in students with neck pain.

Keywords: Cervical spine; limitation of mobility; postural and psychological reactions

INTRODUCTION

The main factor that leads to limited mobility of the cervical spine and restrictions in daily activities is pain. Neck pain is one of the most common musculoskeletal disorders worldwide, with a 1-year prevalence of between 42% and 67% in young adults (1,2). There is growing evidence of a high prevalence of musculoskeletal symptoms in the neck and upper extremities in college students, ranging from 48% to 78% (3). College students are a population at high risk for neck pain. In addition to the pre-disposing factors for pain that are present in the general population, college students are exposed to additional hours of reading, writing, and computer work, making them a high-risk group for the occurrence of neck pain. Neck pain has a multifactorial origin, which means that individual, physical, and biopsychosocial factors lead to its occurrence. In addition, a number of other risk factors have been identified that lead to neck pain, namely: physical, clinical, and lifestyle factors (4).

In addition, the increasing use of new information and communication technologies has led to more and more time being spent texting on cell phones or using computers, which could have a long-term impact on neck pain, possibly due to prolonged neck flexion. Neck flexion can promote forward head posture (FHP), which is a forward position of the head in relation to the shoulder. This is the most common postural defect of the cervical spine in the sagittal plane and is found in varying degrees of severity in almost all population groups. Greater FHP has been associated with greater deficits in the cervical range of motion, particularly in rotation and flexion of the neck. In addition, FHP appears to have a negative impact on static balance control in asymptomatic adults. Despite the claim that FHP may be related to neck pain, the available evidence

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appears to be controversial, as some previous studies have found no significant association between neck pain and FHP, while other studies have found an association between FHP and neck pain (5,6).

In addition to the use of electronic devices, the way, i.e., the posture of working on the computer, cell phone, or tablet, is also important. Previous studies have concluded that the sitting position when using a cell phone is a direct risk factor for neck pain (7). Excessive use of electronic devices while studying and reading can lead to the onset of depression symptoms in students. People who use smartphones for long periods of time lose the natural curve of the cervical spine, which increases stress. This stress leads to a change in the angle of the cervical vertebra and the pain threshold of the shoulder and neck muscles. In addition, the frequent use of smartphones can be a risk factor for depression. Smartphone use causes chronic neck pain by lowering the lordosis of the cervical spine and the pain threshold of the neck muscles. Excessive smartphone use leads to significant strain on the cervical spine and neck pain, which ultimately translates into somatic complaints, anxiety, insomnia, depression, psychological stress, and an unhealthy lifestyle (8).

Functional capacity encompasses the performance of all physical and mental activities. It reflects the complex process of interaction among all body systems and is often not related to structural damage. Two basic levels of functional capacity are distinguished. The first and basic one relates to personal care (hygiene) and movement (dressing, bathing, eating, getting out of bed and out of a chair) and is distinct from the complex activities that enable a person to live independently in the social community, such as housework, working, preparing meals and cooking, driving and/or using public transportation, shopping, etc. The assessment of activities of daily living is carried out with the aim of assessing functional status, identifying limitations in activities, setting goals and a rehabilitation plan, evaluating the results of the intervention, and providing a basis for scientific research (9).

The aim of this study was to determine the mobility limitation of the cervical spine of students with reported neck pain, to determine the degree of disability and depression due to neck pain, to determine the correlation of mobility limitation of the cervical spine with the degree of disability and depression of students, and to determine the correlation of the degree of disability with the degree of depression.

METHODS

A cross-sectional study conducted in the summer semester of the academic year 2020/2021 at four faculties (Medicine, Mechanical Engineering, Law, and Economics) of the University of Zenica involved male and female undergraduate students (regular and regular self-pay students) aged 19-26 years. The approval of the Ethical committee and Vice-Rector for Teaching and Student Affairs of the University of Zenica, dated October 22, 2020, was obtained to conduct the study (number 01-06-1-3388/20). Due to the complex epidemiological situation and online courses, the study was conducted via Google Forms (online form) and lasted from May to July 2021. The questionnaires were forwarded to 896 e-mail addresses, of which 433 students duly completed the online questionnaires. 147 of them reported neck pain, in which functional capacity and mental health were assessed. The criteria for exclusion from the study are: students who did not report neck pain or had limited mobility of the cervical spine; students who were already being treated by a physician for chronic neck pain; and students who had not voluntarily consented to the study. The instruments used in the study were the General Questionnaire, the Neck Pain Disability Index, and the Patient Health Questionnaire (PHQ-9).

The General Questionnaire contains questions, of which the first group of questions relates to general information: gender, age, faculty chosen, student status, year, and subject of study. The second group of questions asked whether the student or participant was currently being treated by a physician for a chronic cervical spine condition and whether pain was experienced during cervical spine movements (flexion, extension, lateral flexion, and rotation).

The neck disability index (NDI) is a standardized questionnaire consisting of ten questions that show how neck pain affects functionality during activities. The questions relate to: pain intensity, personal care, weight lifting, reading, headaches, concentration, work, driving, sleeping, and leisure (recreation). For each question, six answers are offered, which are rated on a scale of 0-5. The maximum score is 50, and for each question, the test taker is asked to mark the answer that best describes their problem. The scores are added together, and, depending on the score achieved, the respondent is placed in one of the categories (0-4–no disability; 5-14–mild disability; 15-24–moderate disability; 25-34–severe disability; >34–total disability) (10). In summarizing the results of the study of the incidence of neck pain in students and its impact on disability in worldwide studies, the authors mainly used the NDI in the research methodology (10-12).

The PHQ-9 is one of the most commonly used questionnaires to assess depression, especially in primary care. It consists of nine questions, and each question assesses how often the patient has experienced a particular symptom in the past 2 weeks (0-never; 1-a few days; 2-more than half of the total days; 3-almost every day). The results are interpreted as follows: results of 0-4 mean no depression; of 5-9 mild depression (sub-depression); 10-14 moderate depression; 15-19 mild depression; 20-27 severe depression (13). The questionnaire is very short, free of charge, and is used in both clinical and research settings, where it has good diagnostic and psychometric properties, especially in primary care (14-16). What is important for this study is that the questionnaire also has good properties in general and non-clinical samples (17).

The SPSS for Windows software package (version 21.0, SPSS Inc., Chicago, Illinois, USA) and Microsoft Excel (version 11, Microsoft Corporation, Redmond, WA, USA) were used to statistically analyze the collected data. The nominal and ordinal variables of the study were analyzed using the χ^2 test. Based on the data obtained, correlation tests were performed in relation to the limited mobility of the cervical spine and the physical and mental abilities of the students. The correlation test (Pearson) was used to determine the relationship and direction of the relationship

between the categories of the variables. The value of $\alpha = 0.05$ was taken as the limit of statistical significance.

RESULTS

Four hundred and thirty-three students from the first 3 years of undergraduate studies at four faculties (medicine, mechanical engineering, law, and economics) of the University of Zenica participated in the study. There were 147 (30.6%) with self-reported neck pain, 3 (0.6%) with chronic pain, and 283 (65.4%) without neck pain (Table 1).

Of the 147 students who reported neck pain, 28 (19%) were male and 119 (81%) were female. The largest number of students, 48 (32.7%), were 20 years old. Neck pain was reported by 68 (46.3%) students from the Faculty of Medicine, 20 (13.6%) from the Faculty of Mechanical Engineering, 23 (15.6%) from the Faculty of Law, and 36 (24.5%) from the Faculty of Economics. A statistically significant difference was found in the proportion of neck pain reported by students according to faculty ($\chi^2 = 11.316$, $p = 0.010$), years of study ($\chi^2 = 6.736$, $p = 0.034$), and age ($\chi^2 = 11.855$, $p = 0.105$) in relation to gender (Table 2).

Restricted flexion due to neck pain was reported by 30.6% of students, of whom 8.2% were male and 22.4% were female, and the majority were medical faculty students (17.7%) and 1st-year students (14.3%). Restricted extension due to neck pain was reported by 21.1% students, of whom 17.7% were female and 3.4% were male, and the majority were medical faculty students (10.2%) and 1st-year students (12.2%). Limited lateral flexion was reported by 22.4% of students, of whom 19.0% were female and 3.4% were male. The majority were medical faculty students (11.6%) and 1st-year students (10.2%). Restricted rotation was reported by (25.9%) students, of whom (21.8%) were female and (4.1%) male, with the majority being students of the Faculty of Economics (9.5%) and 1st-year students (12.9%) (Table 3). No statistically significant association was found between restricted cervical spine mobility and student demographic characteristics ($p > 0.05$), except for the association between students' restricted cervical spine mobility and faculty, where a statistically significant difference was found ($F = 2.840$, $p = 0.040$).

A difference in the degree of disability was found based on the results of the Disability Index due to pain in the necks of the students. Mild disability was found in 86 (58.5%) students, of whom 45 (30.6%) were 1st year students, 19 (12.9%) were 2nd-year students, and 22 (15%) were 3rd-year students. Moderate disability was identified in 35 (23.8%) students, of which 19 (12.9%) were 1st-year students, 10 (6.8%) were 2nd-year students, and 6 (4.1%) were 3rd-year students. A severe disability was found in 4 (2.7%) students in their 1st-year of study. A statistical significance of the association between the degree of disability and the year of study was found ($p < 0.05$) (Table 4).

Based on the total score of the PHQ-9, 67 (45.6%) students were found to have mild depression. In the 1st year of study, 34 (23.1%), in the 2nd year of study, 25 (17.0%), and in the 3rd year of study, 8 (5.4%) students. Moderate depression was found in 27 (18.4%) students. 13 (8.8%) in the 1st year of study and 7 (4.8%) students each in the 2nd and 3rd years of study. Moderate depression was found in 8 (5.4%) students, 6 (4.1%) in the 1st year of study, and one student (0.7%) each in the 2nd and 3rd years of study. Severe depression occurred in 4 (2.7%) students, 3 (2.0%) in the 1st year, and one student (0.7%) in the 3rd year. Statistical significance was found in the relationship between mild and moderate depression and years of study ($p < 0.05$) (Table 5).

A weak negative correlation was found for the relationship between limited cervical spine flexion and degree of disability ($r = -0.088$) and degree of depression ($r = -0.001$) and for the relationship between limited lateral cervical spine flexion and degree of disability ($r = -0.0131$) and degree of depression ($r = -0.059$). A weak positive correlation was found for the relationship between restricted cervical spine extension and degree of disability ($r = 0.090$) and degree of depression ($r = 0.015$) and for the relationship between restricted cervical spine rotation and degree of disability ($r = 0.0134$) and degree of depression ($r = 0.039$) (Table 6). A strong positive correlation was found in the relationship between the degree of disability and the degree of depression in students with reported neck pain ($r = 0.387^{**}$). A scatter plot shows the continuity of the data (Figure 1).

TABLE 1. Presence of the neck pain students

Presence of the neck pain students	Gender				Total	
	Male		Female			
	n	%	n	%	n	%
Reported neck pain	28	6.5	119	27.5	147	34
Chronic neck pain	1	0.2	2	0.4	3	0.6
No neck pain	70	16.4	212	49	282	65.4
Total	99	22.9	334	77.1	433	100.0

TABLE 2. Demographic data of students with reported neck pain

Demographic data	Gender					
	Male		Female		Total	
	n	%	n	%	n	%
Faculty						
Medicine	8	5.4	60	40.8	68	46.3
Mechanical engineering	9	6.1	11	7.5	20	13.6
Law	5	3.4	18	12.2	23	15.6
Economics	6	4.1	30	20.4	36	24.5
Year of study						
First	13	8.8	60	40.8	73	49.7
Second	4	2.7	37	25.2	41	27.9
Third	11	7.5	22	15.0	33	22.4
Age of life						
19 years	5	3.4	17	11.6	22	15.0
20 years	7	4.8	41	27.9	48	32.7
21 years	6	4.1	25	17.0	31	21.1
22 years	8	5.4	12	8.2	20	13.6
23 years	0	0.0	14	9.5	14	9.5
24 years	1	0.7	6	4.1	7	4.8
25 years	1	0.7	1	0.7	2	1.4
26 years	0	0.0	3	2.0	3	2.0
Total	28	19.0	119	81.0	147	100.0

DISCUSSION

Neck pain in young adults is present but poorly researched in the world literature (3). There were 147 (30.6%) with

TABLE 3. Limited mobility of the cervical spine

Demographic data	Limited mobility of the cervical spine				
	Limited flexion	Limited extension	Limited lateral flexion	Limited rotation	Total
	%	%	%	%	%
Gender					
Male	8.2	3.4	3.4	4.1	19.0
Female	22.4	17.7	19.0	21.8	81.0
Total	30.6	21.1	22.4	25.9	100.0
Year of study					
First	14.3	12.2	10.2	12.9	49.7
Second	9.5	6.1	6.1	6.1	27.9
Third	6.8	2.7	6.1	6.8	22.4
Total	30.6	21.1	22.4	25.9	100.0
Faculty					
Medicine	17.7	10.2	11.6	6.8	46.3
Mechanical engineering	4.8	2.0	1.4	5.4	13.6
Law	3.4	3.4	4.8	4.1	15.6
Economics	4.8	5.4	4.8	9.5	24.5
Total	30.6	21.1	22.4	25.9	100.0

TABLE 4. Neck disability index

Disability index	Years of study									
	First		Second		Third		Total		Statistics	
	n	%	n	%	n	%	n	%	χ^2	*p*
No disability	6	4.1	11	7.5	5	3.4	22	15	2,81	0.244
Mild disability	45	30.6	19	12.9	22	15	86	58.5	14.11	0.0008*
Moderate disability	19	12.9	10	6.8	6	4.1	35	23.8	7.6	0.002*
Severe disability	4	2.7	0	0.0	0	0.0	4	2.7	8	0.01*
Total	74	50.3	40	27.2	33	22.4	147	100.0		

*statistical significance

TABLE 5. Patient health questionnaire

PHQ-9	Years of study									
	First		Second		Third		Total		χ^2	*p*
	n	%	n	%	n	%	n	%		
No depression	18	12.2	7	4.8	16	10.9	41	27.9	5.02	0.08
Mild depression	34	23.1	25	17	8	5.4	67	45.6	15.6	0.001*
Moderate depression	13	8.8	7	4.8	7	4.8	27	18.4	2.6	0.2
Moderate severe	6	4.1	1	0,7	1	0.7	8	5.4	6.2	0.04*
Severe depression	3	2.0	0	0.0	1	0.7	4	2.7	3.5	0.1
Total	74	50,3	40	27,2	33	22.4	147	100.0		

*statistical significance

TABLE 6. Correlation limited mobility cervical spine with degree of disability and depression

Correlation	Limited extension	Limited lateral flexion	Limited rotation	Degree of disability	Degree of depression
Limited flexion	−0.343**	−0.355**	−0.392**	−0.088	−0.001
Limited extension	1	−0.281**	−0.305**	0.090	0.015
Limited lateral flexion		1	−0.321**	−0.131	−0.059
Limited rotation			1	0.134	0.039
Degree of disability				1	0.387**
Degree of depression					1

**Strong correlation (p>0.001)

self-reported neck pain, 3 (0.6%) with chronic pain, and 283 (65.4%) without neck pain. An alarmingly high rate of musculoskeletal pain—especially neck pain—has been reported among undergraduate students studying to be healthcare professionals, with a reported annual prevalence ranging from 23.6% to 69.2% in Australia and Saudi Arabia (18,19).

In our study, limited cervical spine mobility in students who reported neck pain was found in limited flexion (30.4%), in rotation (25.9%), in limited lateral flexion (22.9%), and in limited extension (21.1%) students. No studies were identified in Bosnia and Herzegovina and the Western Balkan countries that examined student-reported neck pain.

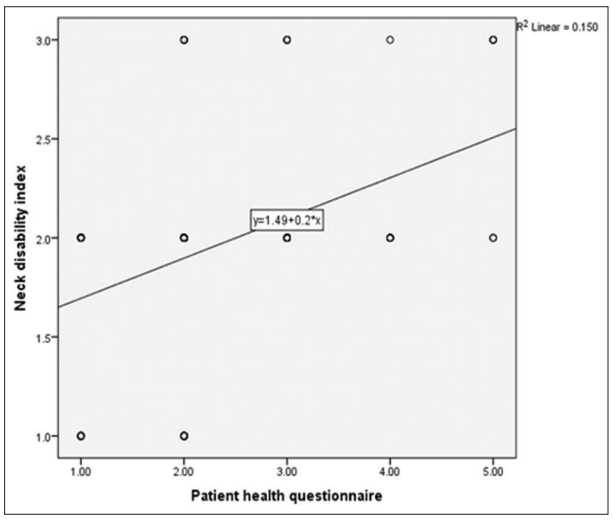

FIGURE 1. Correlation of degree of disability and degree of depression of students with reported neck pain.

In the group that had problems with neck pain, both flexor and extensor muscles are significantly weaker, and the extension movement of the head is significantly lower. These results show that the changes are visible at a very early age and point to the need for early prevention and intervention. Prolonged isometric contraction of the neck extensor muscles promotes increased muscle tension and stress, resulting in neck pain that directly affects cervical spine functionality (18).

In a study based on the results of the Disability Index due to neck pain, the presence of mild (58.5%), moderate (23.8%), and severe disability (2.7%) was found, with a statistically significant difference compared to the observed years of study ($p < 0.05$). The study, conducted among students with reported neck pain during the pandemic, found that mild disability was present in 64.4% and moderate disability in 105 (35.6%) students in a sample of 295 students, and that the highest percentage of disability was found in 1st-year students (19). A study was conducted at the Faculty of Dentistry on 112 apparently healthy students to investigate the occurrence of neck pain and cervical spine dysfunction. The authors of this study found that the majority of students who reported neck pain had mild disability (53.5%) using the Neck Pain Disability Index (20). The results of the aforementioned studies are similar to the results of our study.

Mild depression was found in 67 (45.6%) students, moderate depression in 27 (18.4%), moderate-severe depression in 8 (5.4%), and severe depression in 4 (2.7%) students. Statistical significance was found for the relationship between mild and moderate-severe depression and years of research ($p < 0.05$). A strong positive correlation was found between the level of disability and the level of depression of students with reported neck pain ($r = 0.387^{**}$).

Previous studies have shown that the transition from on-campus to online learning had negative effects on students' mental health (21) and musculoskeletal health (22). A meta-analysis by Chang et al. found that students worldwide were prone to anxiety and depression during the COVID-19 pandemic (23).

Review articles indicate that the strongest psychosocial risk factors in people with chronic back or neck pain are depressed mood (24) and major depression (25). Research conducted in China has shown that mood disorders have a higher comorbidity with neck pain than other mental disorders, and major depression has the highest comorbidity among all mood disorders (26). Adolescents with neck pain have more depressive symptoms than asymptomatic adolescents (27). Depression acts as a mediator between pain and disability (28).

CONCLUSION

Students who reported neck pain were found to have a restricted range of motion in the cervical spine. Restricted flexion and rotation are more common than restricted lateral flexion and extension of the cervical spine, with a predominance of 1st-year students and students in the Faculty of Medicine and Faculty of Economics. About half of the students who reported neck pain had a mild degree of disability and mild depression. A low positive correlation was found between restricted cervical extension and rotation and disability level and depression, and a strong positive correlation was found between disability level and depression in students with reported neck pain.

DECLARATION OF INTERESTS

The authors declare no conflict of interest.

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